

A Classroom Practice and Assessment Resource for Dental Clinical Treatment Planning

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Abstract

Introduction: Dental students' opportunities to practice clinical treatment planning prior to the clinical experience are often limited. This resource permits students to practice treatment planning in the classroom and allows the instructor to efficiently provide feedback to a large number of students. **Methods:** I developed a computer-based treatment plan worksheet (Microsoft Excel, Google Sheets, or Qualtrics) consisting of four sequence steps and a list of Common Dental Terminology (CDT) codes. I implemented this educational activity in the Case Management and Treatment Planning course (second year, spring quarter). The course included 10 weekly sessions of 1 hour each. I gave students a practice case at the beginning of the course. They submitted comprehensive sequenced treatment plans as assignments using the Qualtrics treatment plan worksheet 2 days after the interdisciplinary treatment planning didactic session. In the subsequent debrief session, I discussed the case with the entire class and focused on themes observed from the students' performance on the assignments. **Results:** I graded all students' submissions ($n = 87$) using CDT codes both with and without consideration of sequence steps and observed variations in students' performance. Many students ($n = 36$, 41%) opted to give feedback through an anonymous survey, with 88%-96% of them agreeing or strongly agreeing that the educational activity allowed them to practice, demonstrate their knowledge, and improve their skills in treatment planning. **Discussion:** This computer-based worksheet lets students practice clinical treatment planning in the classroom and allows the instructor to effectively assess a large number of students' assignments.

Keywords

Clinical Treatment Planning, Common Dental Terminology, CDT Codes, Assessment, Dental Informatics, Dentistry

Educational Objectives

By the end of this activity, learners will be able to:

1. Formulate a comprehensive sequenced treatment plan that addresses the patient's chief complaint.
2. Demonstrate skills in clinical treatment planning in the classroom and receive feedback in the form of an objective grade or score.
3. Properly select Common Dental Terminology codes that correspond to the patient treatment plan.

Introduction

Clinical treatment planning is a field of medicine and dentistry that requires background knowledge, critical thinking, and clinical experience.¹⁻³ Standard 2-24 of the Commission on Dental

Accreditation specifies that "graduates must be competent in providing oral health care within the scope of general dentistry... including: a. patient assessment, diagnosis, comprehensive treatment planning, prognosis, and informed consent."³

Common Dental Terminology (CDT) codes are a set of alphanumeric codes developed by the American Dental Association.⁴ Each code represents a unique and precise dental procedure that the practitioner performs on a single site such as a tooth or a quadrant. CDT codes are organized into 12 categories: diagnostic, preventive, restorative, endodontics, periodontics, removable prosthodontics, maxillofacial prosthetics, implant services, fixed prosthodontics, oral and maxillofacial surgery, orthodontics and adjunctive general series.⁴

Medical education increasingly employs case-based learning.^{5,6} It was previously reported that case discussion could improve the clinical performance of students in treatment planning.⁷ Although clinical treatment planning is often taught using case discussion,^{8,9} students' opportunities to practice in the classroom prior to the clinical experience are limited due to the lack of

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practice tools and assessment instruments.⁷ In our dental school, second- and third-year students have indicated that treatment planning in the clinical setting is stressful when they first enter the clinic because they have had few opportunities to practice the required skills, including treatment planning, sequencing, managing the clinic software, and identifying the correct procedure codes. For this reason, practicing these skills during the preclinical setting is critical for a successful clinical experience. Here, I describe a computer-based worksheet that lets students practice sequencing and treatment planning in the classroom and allows the instructor to provide timely and objective scores to a large number of students.

Methods

This study was reviewed by the Institutional Review Board of the University of California, Los Angeles, and met the criteria for exemption (IRB #21-000858).

Treatment Plan Worksheet

This computer-based worksheet was a practice resource that could be used in any relevant course, with any case or any difficulty level, as desired by the instructor (Microsoft Excel [Appendix A], Google Sheets,¹⁰ or Qualtrics [Appendix B]). The treatment plan worksheet consisted of columns for Sequence, Site/Tooth Number, Procedure Code, and Justification (Appendices A and B). Sequence steps were (1) Emergency, systemic, urgent; (2) Disease control; (3) Definitive restorations, replacement of missing teeth, elective treatments; and (4) Maintenance.¹¹ For the Procedure Code, I used a complete list of CDT codes (Appendix A) extracted from the dental students clinic management software axiUm (Exan), as elsewhere described.¹⁰ Each column was equipped with a search function and drop-down data validation menu,¹⁰ which allowed students to quickly identify and enter CDT codes.

Implementation

Case: From the patients' records, I selected and developed an interdisciplinary case with moderately compromised partial anterior edentulism classified as category II according to the American College of Prosthodontics (Appendix C).¹² The case included parameters related to caries diagnosis and treatment, periodontal diagnosis and treatment, assessment of compromised teeth, and replacement of no more than four anterior lower incisors without modifications to the occlusal plane or abutment teeth (Appendix C). A facilitator guide for the session is provided in Appendix D.

Course: The treatment plan worksheet and educational activity were part of a 10-week Case Management and

Treatment Planning course offered to second-year dental students in the spring quarter. At our institution, the course included weekly sessions as follows: (1) ethical and legal considerations, (2) sequential treatment planning, (3) radiographic prescription, (4) periodontal treatment planning, (5) restorative treatment planning, (6) endodontic treatment planning, (7) prosthodontics treatment planning, (8) didactic interdisciplinary treatment planning, (9) educational activity debrief, and (10) review of the clinic management software. Each session was an hour long and was scheduled in a large classroom equipped with a desktop and a projector to display PowerPoint slides. A total of 87 dental students enrolled in this course.

Assignment: At the beginning of the course, approximately 7 weeks prior to the in-class interdisciplinary treatment planning didactic instructions, I gave the case materials and assignment (Appendices A-C) to the students. They were instructed to complete the case assignment and submit comprehensive sequenced treatment plans using the student worksheet (Appendices A and B). Appendix B included instructions on how to modify the Microsoft Excel treatment plan worksheet (Appendix A) into an online Qualtrics form for easier data extraction. Students were also instructed to complete the assignment at any point, including more than once, up until 2 days following the in-class interdisciplinary treatment planning didactic instructions. In our institution, this was the first time learners formulated a comprehensive sequenced treatment plan. As a result, this educational activity could take 1-2 hours of the learners' own time.

Didactic instruction: The in-class interdisciplinary treatment planning didactic instructions (Appendix E) made up 15 minutes of an hour-long session. The session provided guidance for formulating a sequenced treatment plan and reviewed assignment expectations.

Debrief session: In preparation for the debrief session (Appendix F), I graded the students' assignments to obtain objective scores and quantitative information about their performance. First, I exported the data from Qualtrics to Microsoft Excel. Then, I used the filter function in Microsoft Excel to select entries that included the correct combination of Sequence, Site/Tooth Number, and Procedure Code,¹⁰ which allowed me to detect areas of weakness or strength in the students' performance. In addition, to determine students' abilities to sequence a treatment plan, I graded students' assignments both with and without consideration of the sequence steps. The debrief session was an hour long, and I spent about 30 minutes

reviewing the case with the students. In the remaining time, I showed them the data extracted from their assignments. The debrief session was scheduled with the entire class as no statistically significant difference was found in the learning outcomes when using problem-based learning in small- or large-group discussion.¹³ The debrief session was based on quantitative data, as well as on topics and themes observed in the students' performances on the assignments.

Evaluation

At the end of the exercise, students completed a short anonymous survey (Appendix G) using a 5-point scale (strongly agree, agree, neutral, disagree, strongly disagree). Respondents indicated their agreement or disagreement with the following statements:

1. I would recommend using this educational activity to practice clinical treatment planning.
2. The educational activity helped me improve my skills in clinical treatment planning.
3. The educational activity enabled me to demonstrate my knowledge and competency in clinical treatment planning.
4. The Qualtrics worksheet was easy to use.

Students also completed the following yes/no question: Did you have any significant problems that made this Qualtrics Form harder to use?

A space was provided to let students offer any additional comments.

Results

All students enrolled in the course (87 total) completed the assignment. To extract quantitative data and determine the ability of students to write a comprehensive sequenced treatment plan, I graded the students' assignments based on a grading key of 12 points (Appendix D), both with and without consideration of the sequence steps.

Percentages of students correctly identifying sequence and procedure codes are shown in Figure 1. Descriptive statistics representing students' grades are shown in Table 1. Distribution of students' scores was approximately symmetric (skewness between -0.5 and 0.5).¹⁴ When I graded the students' assignments with the correct CDT codes and sequence steps, the median grade was 4 (lower quartile = 2, upper quartile = 5), and students' grades were significantly different from the normal distribution ($p < .001$, Kolmogorov-Smirnov test), with students scoring close to the curve peak (positive excess kurtosis = 0.39).¹⁴ When I graded the assignments without consideration of the sequence steps, students' scores were significantly higher (median = 5, lower quartile = 3, upper quartile = 7; $p < .001$, Wilcoxon signed rank test), with scores tending to be different from normal distribution ($p = .06$, Kolmogorov-Smirnov test), and

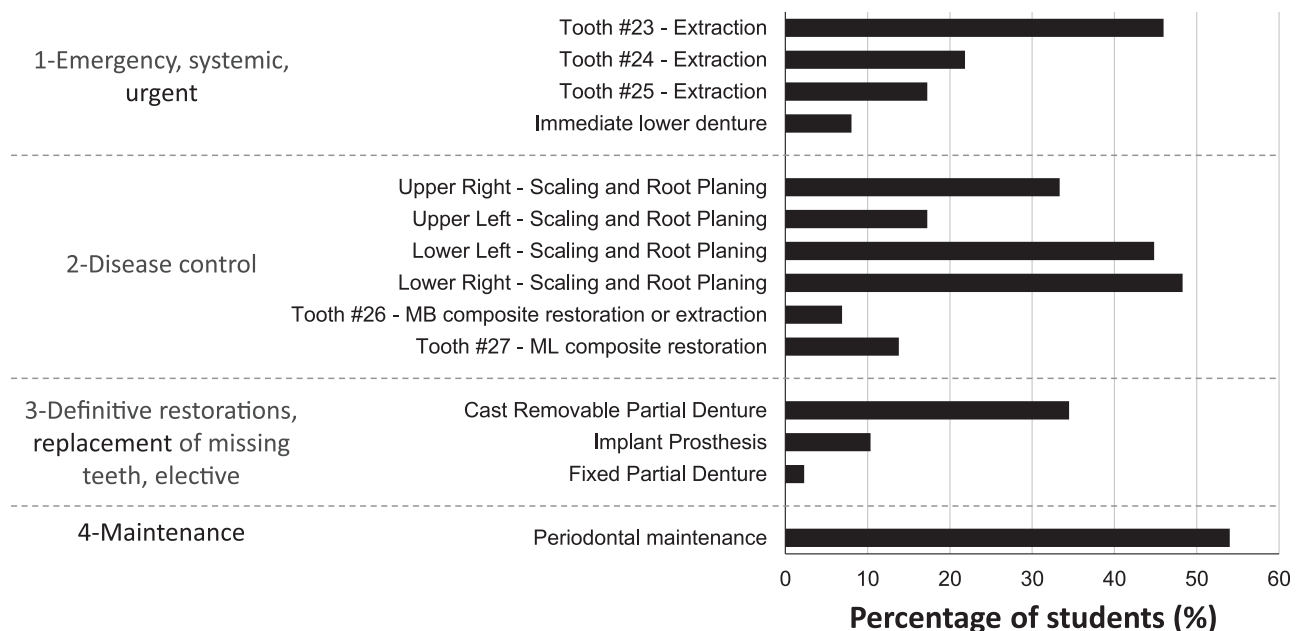


Figure 1. Percentage of students who identified correct sequence and procedure codes. Abbreviations: MB, mesial-buccal surface; ML, mesial-lingual surface.

Table 1. Descriptive Statistics for Student Scores Based on a 12-Point Key Both With and Without Consideration of the Correct Sequence Steps

Statistic	Score: Correct Code and Sequence ^a	Score: Correct Code Only ^a
Minimum	0	0
Lower quartile	2	3
Median	4	5
Mean	4.0	5.1
Upper quartile	5	7
Maximum	10	11
Skewness ^b	0.31	0.12
Excess kurtosis ^c	0.39	-362.00
Kolmogorov-Smirnov test ^d	$p < .001$	$p = .06$

^aStatistically significant difference ($p < .001$, Wilcoxon signed rank test).
^bValue between -0.5 and 0.5 indicates approximately symmetric data distribution.
^cCalculated by SPSS. Positive value (>0) indicates a peaked curve (i.e., thin and high peak). Negative value (<0) indicates a flatter curve (i.e., broad peak and thick tails).
^d $p < .05$ indicates statistically significant difference from normal distribution.

students' scores following a flatter distribution curve (negative excess kurtosis = -362.00).¹⁴

Prior to receiving feedback in the debrief session, seven students sought additional practice and submitted two Qualtrics forms (range: 0-6 weeks between the first and second submissions). I found statistically significant higher scores in the second submission compared to the first submission (median first submission = 4, minimum = 0, maximum = 6; median second submission = 7, minimum = 1, maximum = 8; $p = .03$, Wilcoxon signed rank test).

After the practice exercise, many students ($n = 36$, 41%) opted to complete an anonymous survey. Overall, respondents provided positive feedback and wrote positive comments (Table 2). About 88%-96% of respondents agreed or strongly agreed that the educational activity helped them improve their skills, that it

Table 2. Student Comments About the Educational Activity

Student	Comment
Student 1	"The case is interesting and helpful to practice treatment planning."
Student 2	"I think having one or two more cases to treatment plan would further provide opportunities for me to practice my clinical treatment planning skills.... Having a case where the patient has different extents of caries, partial edentulism, possible failing restorations would have been a nice challenge."
Student 3	"I would include more treatment planning cases like the one we did because I learned more about the breadth of dentistry and clinic options more from that than any lecture we have had in this D2 year."
Student 4	"I think more cases should be done throughout the quarter."
Student 5	"An additional space in the form to make more comments would be helpful. We sort of had to infer what the patient's preferences were and how the results of the initial treatment went—might be beneficial in terms of explaining "why" we made a certain treatment choice."

allowed them to demonstrate their knowledge and competency, and that they would recommend it to practice clinical treatment planning (Figure 2). In addition, 83% of respondents reported no technical difficulties using the Qualtrics treatment plan worksheet.

Discussion

This treatment plan resource met its objectives. It let students practice formulating sequenced treatment plans in the classroom, while allowing the instructor to objectively assess a large number of the students' assignments. The educational activity was designed for second-year dental students with no clinical experience. Prior to receiving feedback in the debrief session, students who submitted two treatment plans had significantly higher scores on the second attempt compared to the first attempt. This suggests that students' abilities to formulate a better sequenced treatment plan improved with practice. Therefore, it is critical for students to practice in the classroom to maximize their learning experience in the clinic.

Although different methods could be employed to teach treatment planning, case discussion seems to yield positive outcomes.⁷⁻⁹ A previous survey reported great variation in approaches for teaching prognosis and treatment planning among U.S. dental schools, with 19% reporting not having a specific method for teaching these topics.¹⁵ The survey authors listed several reasons, including lack of a specific department for teaching prognosis, the interdisciplinary nature of the concept, differences in school size, and lack of resources.¹⁵

In the same survey, respondents reported that students sometimes or often made the wrong determination regarding compromised teeth.¹⁵ However, this determination is difficult to estimate objectively without quantitative data from students. Since each of the CDT codes represents a unique and precise dental procedure, these codes can be used to objectively assess students' responses and provide quantitative data that can be aggregated to detect areas of strength or weakness in class performance—data that are not typically available when asking open-ended questions, short-answer questions, or structured essays.¹⁶ These aggregated data can also illustrate patterns in students' decision-making and sequencing that are not possible to demonstrate through assessments with multiple-choice questions. In a multiple-choice response, the data would only indicate whether the students know the right or wrong answer. In contrast, the CDT method provides additional layers of detail to illuminate the treatment sequence. For instance, by using this approach, I could quickly assess the ability of students to address the patient's chief complaint. To illustrate this point with

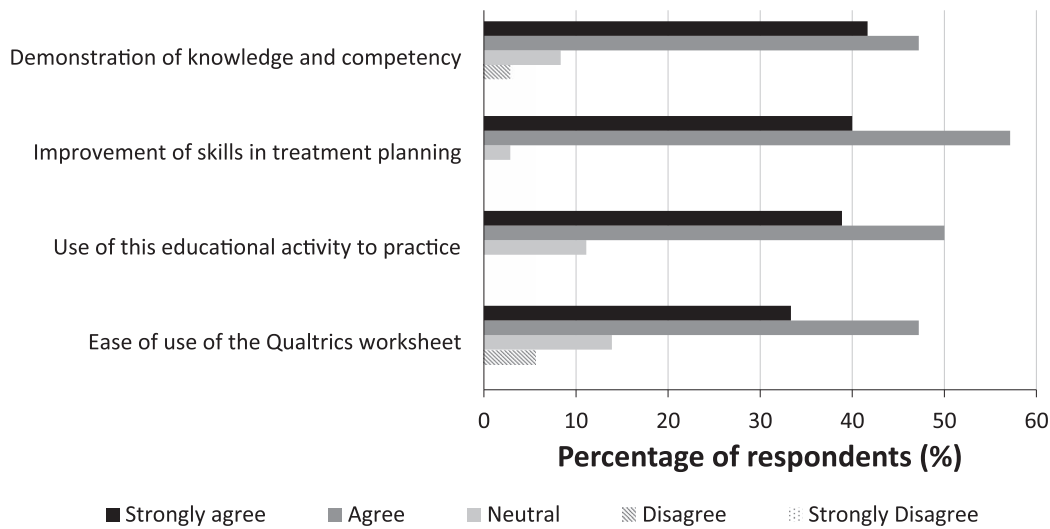


Figure 2. Student survey results regarding the educational activity.

an example, in the case provided in this module, I was able to identify that 62% of students prescribed extraction of tooth 23 in accordance with correct exercise objectives (Figure 1). Of these students, 46% prescribed extraction as an urgent treatment, whereas 16% prescribed extraction at the disease control phase. This type of data would be much more difficult to collect using conventional methodologies.

The use of technological resources in education has become indispensable. Individuals, especially in the newer generations, learn more by trying and doing than by reading or being told.^{17,18} Currently, students have no opportunity to practice until they enter the clinic, but this resource allows them to practice in the classroom before clinic so that they become familiar with entering codes and sequence steps in the clinic management software. Thus, this method could be appealing to the current generation of students who embrace analytics and prefer to practice and receive timely feedback in form of an objective score.¹⁸ Furthermore, although dental students vary in their abilities to use technical tools, students ranked the treatment plan worksheet favorably (Figure 2). They felt that the worksheet was easy to use and gave me feedback to improve it (Table 2).

Treatment planning is a field of dentistry that combines notions of communication skills, clinical skills, and critical thinking.¹⁻³ Students frequently have to master these skills simultaneously in a live clinic setting during their encounters with patients. Unfortunately, students' opportunities to practice before the clinical experience are often limited. In addition, students usually have only a small number of cases in their patient pool. It was previously reported that using cases to teach clinical treatment

planning in the classroom improves the performance of the students in the clinic⁷ and gives them a wide range of exposure instead of being limited by their patient pool. This resource allows students to practice in the classroom in the context of any course, any case, and any complexity level. It also helps students become familiar with CDT codes and learn to sequence treatment plans. As an added feature, it permits instructors to effectively assess a large number of students in the classroom. Once students become comfortable with procedure codes, sequencing, and treatment planning, they can focus on their clinical skills and communication skills instead of having to master these tasks simultaneously.

Appendices

- A. Treatment Plan Worksheet - Excel Version.xlsx
- B. Treatment Plan Worksheet - Qualtrics Version.docx
- C. Course Educational Case.pptx
- D. Facilitator Guide.docx
- E. Facilitator Didactic Instructions.pptx
- F. Facilitator Debrief Session.pptx
- G. Educational Activity Evaluation Form.docx

All appendices are peer reviewed as integral parts of the Original Publication.

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Disclosures

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Prior Presentations

Jabbour Z, Carreon J, Tran M. Google-Sheets: innovative teaching and assessment tool for clinical treatment planning. ADEA Annual Session & Exhibition; March 19-22, 2022; Philadelphia, PA.

Ethical Approval

The University of California, Los Angeles, Institutional Review Board deemed further review of this project not necessary.

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